Web-based Home Telemedicine System for Orthopaedics

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ABSTRACT

Traditionally, telemedicine systems have been designed to improve access to care by allowing physicians to consult a specialist about a case without sending the patient to another location, which may be difficult or time-consuming to reach. The cost of the equipment and network bandwidth needed for this consultation has restricted telemedicine use to contact between physicians instead of between patients and physicians. Recently, however, the wide availability of Internet connectivity and client and server software for e-mail, world wide web, and conferencing has made low-cost telemedicine applications feasible. In this work, we present a web-based system for asynchronous multimedia messaging between shoulder replacement surgery patients at home and their surgeons. A web browser plug-in was developed to simplify the process of capturing video and transferring it to a web site. The video capture plug-in can be used as a template to construct a plug-in that captures and transfers any type of data to a web server. For example, readings from home biosensor instruments (e.g., blood glucose meters and spirometers) that can be connected to a computing platform can be transferred to a home telemedicine web site. Both patients and doctors can access this web site to monitor progress longitudinally. The system has been tested with 3 subjects for the past 7 weeks, and we plan to continue testing in the foreseeable future.

Keywords: telemedicine, home monitoring, web, Internet, shoulder replacement arthroplasty, physical therapy, rehabilitation

1. INTRODUCTION

Since the earliest documented telemedicine studies, the focus of telemedicine has mainly been on using videoconferencing to replace an in-person visit.[1,2] It has been noted in teleradiology, however, that the store-and-forward model is more practical because it eliminates the need for scheduling.[3] Store-and-forward in the form of a simple e-mail for physician-patient communication was first documented in 1994[4,5] and discussions of the technical and social issues followed.[6,7,8] As more people are becoming connected to the Internet, e-mail is becoming an attractive option for patients and physicians to contact each other. The primary benefit of e-mail is that each person in the communication does not need to be available at the same time. This is a requirement for the real-time videoconferencing type of telemedicine and is clinically very difficult to meet. Another benefit of e-mail is the recorded nature of the communication. Patients, families, and physicians can go back and read old messages as often as they need. For example, doctors can refer to the details of a patient's question from several months ago and patients can reread doctor's instructions as often as needed. E-mail interactions are also easy to document by either adding them directly to a patient's electronic medical record or printing them out to include in a paper medical record. E-mail is also more convenient for patients and providers than contact by telephone or office visits. They can access each other without waste of energy, time, or money, which is particularly important for individuals who are disabled.

Although e-mail has a number of attractive properties, there are also a number of drawbacks. Intermediate networks along the delivery route of an e-mail message can eavesdrop on the communication. This has caused some concern if patients use their employer's network to send e-mail messages to their physician. Although it is now possible to encrypt messages in many popular e-mail programs, the reports of patient-physician e-mail usage to date have shown that encrypting messages is not widely practiced. In order to use encryption, users must obtain keys identifying the recipients of their messages. Although an infrastructure for key distribution and authentication across the Internet is in place, it is more commonly used by enterprises, such as commercial web sites, rather than by individuals. In addition to the encryption issue, there is also an issue that e-mail contacts are not structured, which can lead to inefficiency. For example, follow-up messages to previous contacts from a patient are mixed in with appointment requests in a physician's inbox, and messages must be manually added to a patient's medical record. Even with the sophisticated filtering capabilities in e-mail programs, adding structure to e-mail contacts is difficult and transferring the information from an e-mail into an electronic medical record tedious.